

Frequency and in-Hospital Mortality of Right Ventricular Infarction in Patients of Inferior ST-Segment Elevation Myocardial Infarction

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ABSTRACT

Aim: To evaluate frequency and in-hospital mortality of right ventricular infarction in patients of inferior ST-segment elevation myocardial infarction.

Methods: The study was descriptive case series. The study included 150 consecutive patients with inferior ST-segment elevation myocardial infarction (STEMI). Inferior STEMI was diagnosed by ST-segment elevation in electrocardiographic leads II, III & aVF and RV infarction was diagnosed by clinical examination (low blood pressure, raised JVP and clear lung fields), further augmented by ST-segment elevation in right precordial ECG leads especially V_{4R} . The numerical variables were presented as mean and standard deviation while qualitative variables were presented as frequency and percentage.

Results: The mean age was 55 ± 11.9 years and 80% patients were male. Of 150 patients, 36(24%) were having inferior STEMI with RVI. In-hospital mortality rate was 10(28%) in patient inferior MI with RVI.

Conclusion: RVI frequently complicates inferior MI and results in increase in mortality.

Keywords: Inferior Wall MI, Right Ventricular Infarction, Mortality.

INTRODUCTION

Ischemic heart disease (IHD) is a common clinical entity. It has a vast clinical spectrum ranging from stable angina through unstable angina to myocardial infarction (MI). It is more common in males. The major risk factors of IHD are diabetes mellitus (DM), hypertension, smoking, hyperlipidemia and family history of IHD.

Myocardial infarction is the necrosis of the myocytes due to interruption of blood supply. MI can be of anterior, inferior, lateral or posterior walls of left ventricle depending upon the vessel supplying the area. The inferior MI is considered to have a better prognosis than anterior MI¹. Acute inferior wall MI frequently involves the right ventricle (RV). Post mortem studies revealed that there is RV infarction in 19% to 51% of patients with acute inferior MI². RV infarction contributes markedly to hemodynamic instability, atrioventricular (AV) conduction blocks and in-hospital mortality in patients with inferior MI. Patients with inferior MI, who have RV infarction, appear to have a worse prognosis than those who don't have RV infarction³.

The diagnosis of the RV infarction can be made from the physical examination, electrocardiography (ECG), echocardiography, hemodynamic measurements⁴ and radionuclide scanning⁵.

The clinical triad of hypotension, raised jugular venous pressure (JVP) and clear lung fields in patient with inferior MI is virtually pathognomonic for RV infarction.¹ Kussmaul's sign (a late inspiratory increase in JVP) has also been shown to be sensitive and specific for RV infarction. Other physical findings may include right ventricular gallops and tricuspid regurgitation (TR)¹.

The precordial ECG is the most readily available, simplest, objective, non-invasive and cost effective technique for diagnosing RV infarction^{6,7}. The presence of ST-segment elevation, Q waves or both in the right precordial leads (V_3 through V_6), is found to be highly reliable in diagnosing RV infarction and has been used to relate infarct size to the prognosis. ST-segment elevation in lead V_{4R} has an overall sensitivity of 88%, specificity of 78% and a diagnosing accuracy of 83% for the diagnosis of RV involvement during acute inferior MI and ST-segment elevation in lead V_{4R} is a strong independent prognostic marker and superior to other clinical variables.¹ Furthermore, ST-segment depression in precordial leads has been associated with large infarction, worse wall motion abnormalities, lower ejection fraction and high short and long term complications and mortality⁸.

RV infarction can lead to serious complications like cardiogenic shock, arrhythmia (e.g., atrial fibrillation, ventricular tachycardia & fibrillation etc.) and atrioventricular blocks. Other complications can

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be pericarditis, ventricular septal defect (VSD), tricuspid regurgitation, right ventricular thrombus formation and subsequent pulmonary embolism and a unique complication of right to left shunt through the patent foramen ovale (PFO)⁹.

It is generally believed that patients with inferior MI have unfavorable prognosis. When inferior MI is complicated by RV infarction, the in-hospital mortality may be as high as 31% as compared to 6% for patients with inferior MI without RV infarction.¹⁰ The exact data regarding incidence of RV infarction and its complications in Pakistan is not available. A study conducted in Pakistan by Khan et al revealed that RV infarction was found in approximately one-third of inferior MI patients and RV infarction was associated with considerable morbidity and mortality and its presence defines a higher risk subgroup of patients with inferior wall left ventricular infarction¹⁰.

In another study by Ali et al the incidence of RV infarction was 28% and mortality rate was 33% (as compared to 2.6% for patients with inferior MI) with a significant higher risk of other complications¹¹.

This study was designed to show that RV infarction in patients with inferior MI increases the risk of in-hospital mortality.

METHODS & MATERIAL

The study included 150 consecutive patients admitted to the emergency room with inferior ST-segment elevation MI diagnosed by typical chest pain lasting more than 30 minutes but less than 24 hours, ST-segment elevation of ≥ 0.1 mV in two or more of leads II, III and aVF and rise of serum CK-MB to more than twice the normal value.

After getting informed consent, detailed history of the patient was taken including age, gender, presenting complaints & associated symptoms and risk factors.

A thorough clinical examination was performed including pulse, blood pressure, JVP, and inspection, palpation and auscultation of the precordium. The relevant examination was done to assess the presence of signs of right ventricular infarction and other complications. The clinical findings were noted during the whole hospital stay.

A standard 12 lead ECG (with leads I through III, aVR, aVL, aVF and V₁ to V₆) was recorded immediately after the admission to the hospital. Right sided precordial leads (V_{3R} through V_{6R}) were also recorded. ST-segment deviation was assessed 0.04 second after the J point. Echocardiography (including M-mode, 2-Dimensional, Doppler and color flow mapping) was done for all patients.

Thrombolytic therapy was given to all eligible patients without contraindications to thrombolysis. All patients

were given standard treatment of acute myocardial infarction including oxygen, Aspirin, analgesics and nitrates & heparin for those with contraindications to thrombolysis followed by b-blockers and ACE-Inhibitors. Necessary treatment and measures were taken for the complications.

All patients were closely monitored during the whole hospital stay. In-hospital outcome was studied in terms of mortality of the patient. All patients of both genders with acute inferior ST-segment elevation MI, acute infero-posterior MI and acute infero-lateral MI with and without RV infarction were included in this study.

Patients with the following conditions were excluded from the study; Prior MI, Pre-existing heart failure, Valvular heart disease, Pericardial disease, Acute pulmonary embolism, Significant pulmonary diseases.

All the data obtained was entered on preformed data collection forms. All the data was fed into statistical package for social sciences (SPSS version 16.0). Numerical variables like age were presented by mean and standard deviation. Qualitative variables like gender, risk factors (DM, hypertension, smoking, hyperlipidemia, and family history of IHD), thrombolysis, complications and mortality were presented as frequency and percentage. The study population was divided into two groups. Group 1 included patients of inferior wall MI and groups 2 included patients of inferior wall MI with right ventricular infarction. The two groups were compared using chi square test. A p value of ≤ 0.05 was considered significant.

RESULTS

A total 150 patients were included in study. There were 120 (80%) male. The age varied between 32-85 years (mean=55 \pm 11.9). Out of 150 patients, 36 (24%) have inferior MI with RV infarction. The prevalence of diabetes mellitus, hypertension, smoking, Hyperlipidemia and family history was higher in patients of inferior MI with RV infarction. In-hospital mortality was 6/114 (5%) deaths in patients of inferior MI and 10/36 (28%) in patients with RV infarction. The major causes of death were cardiogenic shock, AV blocks and ventricular arrhythmia.

Table: In-hospital mortality in patients of inferior MI & inferior MI with RVI

Complications	Deaths
IWMI (n=114)	6(5%)
IWMI + RVI (n=36)	10(28%)
P value	<0.001

DISCUSSION

The incidence of RV infarction ranges from 10-50% depending upon the series^{12,13}. The potential haemodynamic derangements associated with right ventricular infarction render the afflicted patient unusually sensitive to diminished pre-load (i.e., volume) and loss of atrio-ventricular synchrony. These two circumstances can result in a severe decrease in right and secondarily, left ventricular output.¹⁴ A subtle clue to the haemodynamically significant RV infarction is a marked sensitivity to preload reducing agents such as nitrates, morphine and diuretics.¹⁵ Patients with haemodynamically significant RV infarction may develop hypotension, jugular venous distension and occasionally shock, all in the presence of clear lung fields¹⁶. A high incidence of hypotension and cardiogenic shock has been documented in RV infarction^{12,13,14,15,16}.

In this study patients with acute inferior wall myocardial infarction with right ventricular infarction had a relatively bad prognosis compared to those without right ventricular infarction. The presence of RV infarction is a strong indicator of in-hospital death and is associated with a higher incidence of major complications. These findings are consistent with studies by Zehender et al¹.

The prevalence of RV infarction with inferior wall MI was 24% in this study as compared to prevalence of right ventricular infarction in study by Cintron et al.¹⁷ Similarly right ventricular infarction was present in 32% patients in study by Zeymer et al by using electrocardiographic (ECG) criteria for diagnosis¹⁸. Piotr Kukla et al. reported an incidence RV infarction of 35.9% by using ECG criteria¹⁹. Various studies conducted in Pakistan on inferior wall myocardial infarction and RV infarction showed incidence of 28% by Ali et al¹¹ incidence of 30% by Akber et al²⁰ and 34% by Khan et al.¹⁰ A very high incidence of 97% of RV infarction in inferior wall MI was documented by Asano et al.²¹ by using dual energy single photon emission computed tomography (SPECT) with Thallium-99m pyrophosphate and Thallium-201. The low prevalence of right ventricular involvement in inferior wall MI in this study may be due to lack of sophisticated diagnostic facilities like radionuclide ventriculography and sequential 99TcM-pyrophosphate scan.

In this study, mortality is considerably high in patients of inferior MI with RV infarction as compared to patients who have inferior wall MI only i.e. 28% vs. 5% ($p < 0.001$). Zehender et al showed 31% mortality in patients with inferior wall MI with RV infarction as compared to 6% for those with inferior wall MI only.¹ Ali et al reported a mortality rate of 33.3% in patients with right ventricular infarction compared with 2.6%

without right ventricle infarction in inferior wall MI¹¹. The causes of death were cardiogenic shock, AV blocks and ventricular arrhythmias which was higher in RV infarction group.

Treatment of RV infarction with haemodynamic compromise is aimed at increasing preload by fluid resuscitation to Central Venous Pressure (CVP) 16-20 cm of H₂O, avoidance of nitrates, diuretics, morphine; maintaining atrio-ventricular synchrony by AV sequential pacing for complete heart block, prompt cardioversion for atrial fibrillation and ventricular arrhythmia, judicious use of inotropic agents and reducing right ventricular afterload by aortic balloon counter pulsation, vasodilators (sodium nitroprusside), reperfusion by thrombolytic agents or direct angioplasty⁴.

CONCLUSION

The patients with inferior MI are frequently complicated by RV infarction and are at increased risk of morbidity and mortality.

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